

Course emotional value extraction and curriculum politics implementation case design

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Abstract: The core of carrying out curriculum politics teaching activities is to effectively refine the emotional value of the curriculum, design and implement it, so that students can learn knowledge and skills, strengthen scientific literacy education, form good behavior norms, and have political literacy in line with social development. Taking the course of "Applied Electrochemistry" as an example, according to the requirements of engineering education certification in China, this paper refines six curriculum politics themes based on the course content and designs them into classroom teaching. It focuses on how teachers can effectively refine and rationally design the emotional value of engineering courses, and gives a curriculum political design scheme with both objective and emotional value. It analyzes the promotion effect of the implementation of curriculum ideological and political education on achieving the goal of educating people, hoping to provide reference for the design of other curriculum ideological and political education.

Key words: curriculum; politics; engineering; education accreditation; emotional value; engineering ethic; scientific concept of development

1 Introduction

In the context of China's industrial development transitioning into a technology-intensive and innovation-driven era, the "New Engineering" initiative was introduced in 2017 with the aim of nurturing a cohort of outstanding engineering and technology professionals who possess innovation and entrepreneurial capabilities, cross-disciplinary integration skills, and high-quality attributes[1][2]. Within this new educational framework, the concept of "curriculum ideological and political education" significantly enriches the pathways to meet the educational requirements. By aligning with the specific objectives of professional talent development, it involves reshaping curriculum content and teaching methodologies, exploring the emotional and ethical values embedded within courses, and establishing a repository of cases suitable for professional training that, in addition to imparting knowledge, also impart values.

2 New talent development objectives in the new era

Guided by the outcomes-based education philosophy, the educational standards serve as the primary criteria for assessing the achievements of talent development. It is crucial that these standards align with the demands of industry development. Table 1 provides the 12 educational standards used in China's engineering education accreditation [3][4]. Li Jianguang argues that standards 6-12 embody the three levels and dimensions of Bloom's educational objectives

classification: cognitive, skill-based, and affective, all centered on individual student development [5]. The implementation of curriculum ideological and political education can subconsciously influence students' value orientation, facilitating the attainment of standards 6-12 and, more importantly, the fundamental goal of fostering good character and well-rounded individuals. Liu Fengjuan discusses the necessity and significance of curriculum ideological and political education from the perspective of implicit ideological education [6], while Liu Gen explores curriculum ideology in the context of industry application within the "Applied Electrochemistry" course [7]. Currently, there is a limited discussion on the relationship between curriculum ideology and the design of graduate requirements. Researchers like Yu Haitao and Zhao Yue, in conjunction with professional engineering education accreditation, have analyzed the necessity of curriculum ideology, building a comprehensive system for moral education within chemical engineering programs, providing valuable references for engineering education accreditation and the practical implementation of curriculum ideology[8][9]. However, specific curriculum implementation plans remain in short supply. This article takes the "Applied Electrochemistry" course as an example and focuses on discussing the role of curriculum ideology in promoting the achievement of course objectives within the context of talent development.

Table 1. Graduation requirements of engineering education certification in China and the course support of "Applied Electrochemistry"

Index content		Course support analysis of "Applied Electrochemistry"
1	Engineering knowledge	Can use chemical, physical and other basic and professional knowledge to solve the problems of production rate, materials, energy and other problems of electrochemical industry.
2	Problem analysis	Can apply the basic principles of electrochemistry to analyze production engineering problems, like improving production efficiency, and can conduct professional literature analysis.
3	Design/develop the solution	Understand the design principles of electrochemical reactor, master the classic electrolysis process and battery process, understand the economic status of electroplating and battery industry, as well as relevant knowledge on environmental protection, safety, culture, and other topics.
4	Research	Basic electrochemical test methods will be selected for reaction mechanism analysis, reaction speed control to understand the experimental data and basic analysis.
5	Use modern tools	Understand industry standards, advanced technology, professional websites and other information, understand the application of electrode preparation technology, electrochemical testing technology points.
6	Engineering and society	It will initially evaluate the impact of electrochemical production and technical improvement activities on society, health, safety, law and culture, understanding the responsibilities of the engineer.
7	Environment and sustainable development	Understand the impact of toxic wastes in electroplating and battery production and scrapping activities on the environment, and understand the significance of green production activities for the sustainable development of the society.
8	Professional norms	Design ideological and political cases, guiding students to realize the social responsibility of engineers in electrochemical production activities, and follow the moral norms.

9	Individual and team	Complete group homework training, encourage students to participate in extracurricular competitions, associations, scientific research and other activities.
10	Communicate	Take the anticorrosion work of Hong Kong-Zhuhai-Macao Bridge as the discussion topic and express opinions; write the research paper of electrochemical industry.
11	Project management	Understand the methods of production management and decision-making by adjusting the electrochemical economic production technical indicators and material and energy transfer methods.
12	Lifelong learning	From the perspective of the rapid development and change of the new energy industry and the rapid change of the society, we will guide students to establish the attitude of lifelong learning.

3 Curriculum ideology design based on talent development needs

The course "Applied Electrochemistry" primarily comprises two major modules: fundamental theory and practical applications in the field of electrochemistry. Its application areas encompass chemical power sources, surface treatment, environmental protection, corrosion prevention, and more. This equips students with the knowledge and skills to pursue professional careers in fields such as energy, materials synthesis, and environmental protection. The role of this course in the talent development system is analyzed in Table 1.

Based on the course content, the author has distilled six elements of curriculum ideology, namely scientific development perspective, craftsmanship spirit, patriotism, engineering ethics, critical thinking and innovation, and communication and collaboration. These elements serve as the bridge connecting course content with the achievement of course objectives. Fig. 1 illustrates the supportive relationship between course content and these ideological elements in achieving course objectives.

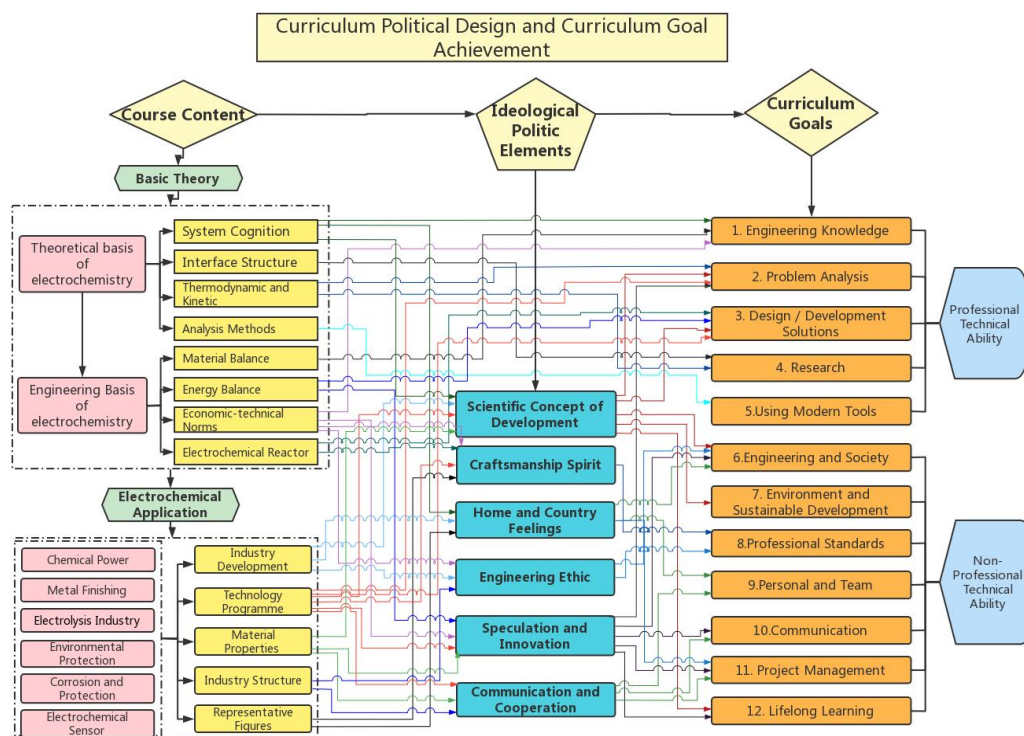


Fig. 1. Ideological and political design and supporting analysis of course objectives

4 Integration of ideological cases into design and skill development

Building upon the relationship between curriculum content, ideological design, and the achievement of course objectives as demonstrated in Fig.1, this section will elaborate on the design, implementation of various ideological elements, and their connections to the respective course objectives.

4.1 Element design of the scientific development perspective

The core of this element's design is to summarize the laws of discipline and industry development, historical characteristics, and the driving forces propelling discipline and industry growth. It is linked to four content modules: understanding of electrochemical systems, industry development and economic impact, technical solutions and research and development, and material utilization and research, for instance, analyzing the patterns of change in societal energy structures and the inevitability and contingency of metal corrosion. This element supports students in thinking critically based on scientific principles and rules, contributing to the achievement of the "problem analysis" skill requirement.

From the perspective of societal and personal development, the scientific development perspective emphasizes "putting people first" and cultivating a comprehensive, coordinated, and sustainable development view, promoting the comprehensive development of the economy, society, and individuals. It guides students to recognize the importance of "lifelong learning" for personal development. By adopting the role of an engineer during teaching, it enhances students' sense of identity, helping them understand the significance of "engineering in society" and evaluate the impact of solutions to engineering issues on society and health. This aids in comprehending the responsibilities they must undertake [10].

4.2 Design of the craftsmanship spirit element and achievement of objectives

Since the release of "Made in China 2025" in 2015, there has been an explosive growth in key literature focusing on the theme of craftsmanship spirit. Promoting craftsmanship spirit is a significant initiative for advancing the comprehensive development of high-end manufacturing in China. It is considered that the soul of industrial manufacturing, and the development of the craftsmanship spirit contribute to the realization of students' self-worth and align with the concept of "lifelong learning". This element mainly revolves around the design of electrochemical reactors, technological improvements and research and development, and industry-leading figures. For example, high-end manufacturing demands meticulous attention to the quality of electroplated coatings on workpieces and careful design and polishing of reactors to find the best process conditions. This element aids students in achieving the graduation requirement of "professional norms".

4.3 Design of the patriotic element and achievement of objectives

Patriotism serves as an important foundation for students to identify with their individual identity and develop a sense of belonging, aligning with Maslow's hierarchy of needs related to "belonging and love". It primarily revolves around the content modules related to representative companies and figures within the industry. For example, stories such as China's dominant position in the global lithium-ion battery market and China being the largest producer of chlor-alkali products can motivate students to contribute to the development of the Chinese electrochemical industry. This, in turn, fosters a sense of national pride and a sense of belonging and identity, which contributes to the achievement of graduation requirements related to "engineering in society" and "individual and team".

4.4 Design of the engineering ethics element and achievement of objectives

The concept of engineering ethics arose from discussions of technological disasters, such as the recent events concerning nuclear leaks and the discharge of nuclear wastewater in Japan. These incidents are rooted in the tendency to neglect the safety and health of the public when engaging in engineering activities. Unlike many other professions, engineering has a significant impact on the environment, and engineers have a primary duty to the health, welfare, and

safety of the public. Hence, incorporating the concept of engineering ethics into engineering courses is of paramount importance. It primarily focuses on how engineering and technological activities impact societal and ecological environments. Case discussions can include why it is necessary to mandate the closure of most low-cost lead-acid battery factories, how to employ electrochemical methods for waste treatment, and how to reduce energy consumption while ensuring production efficiency, engaging in carbon-neutral and carbon-reduction activities, and more. The inclusion of engineering ethics helps students gain a deeper understanding of various indicators such as "engineering in society", "environment and sustainable development", "professional norms", "project management", and their respective connotations.

4.5 Design of the critical thinking and innovation element and achievement of objectives

Fudan University's professor Xiong Hao offers a nationally acclaimed online open course, "Critical Thinking and Innovation," with nearly 500,000 cumulative enrollees. Mastering constructive thinking is an essential foundation for continuous self-improvement. It can particularly assist students in achieving the skill requirements of "problem analysis", "engineering in society", "communication", "project management" and "lifelong learning". This element is designed around developing students' ability to think critically about engineering problems, analyze the factors involved, balance pros and cons, and make informed decisions. For instance, students may need to consider how to balance production efficiency and energy consumption, choose the appropriate technical solutions, select suitable materials, optimize material performance, and rationally evaluate the advantages and disadvantages of new energy vehicles versus traditional fuel vehicles and their market competition. Learning to think critically and internalizing knowledge is an essential step in converting knowledge into competence.

4.6 Design of the communication and collaboration element and achievement of objectives

The core of communication element design is to enable students to express their viewpoints in the classroom, including participation in various forms of class discussions, knowledge debates, thematic presentations, and more. The collaboration element is mainly about identifying suitable partners, establishing common goals, dividing tasks, and collaborating effectively. An example could be the cooperation along the upstream, midstream, and downstream segments of the lithium-ion battery industry chain, allowing students to become familiar with the industry composition and understand the importance of cooperation and coordination for both industry and personal development.

5 Conclusion

The curriculum ideology concept aligns with the fundamental requirements for talent development as specified in the national standards for teaching quality. It contributes to improving the quality of talent development in engineering disciplines. This article, based on the OBE philosophy, focuses on the design of how curriculum ideology promotes the achievement of course objectives, introducing six ideological elements: the scientific development perspective, craftsmanship spirit, patriotic spirit, engineering ethics, critical thinking and innovation, and communication and collaboration. By incorporating examples from textbooks, online resources, and everyday life into the classroom and combining them with course content, students are assisted in achieving course objectives and promoting the attainment of graduation skill requirements.

It is worth noting that as frontline educators, we need to overcome the drawback of placing a heavy emphasis on imparting specialized knowledge at the expense of nurturing moral qualities. Educators should lead by example and break free from the traditional mindset of "I must teach the students". Instead, by adopting rational curriculum ideology designs, they can guide students to develop scientific understanding, good behavioral standards, strong political awareness, and a rich spiritual culture. Additionally, educational authorities should recognize the objective reality of "cultivating individuals

over the long term" and grant teachers full autonomy during the implementation of curriculum ideology. Continuous teacher training and discussions are essential, and with time and experience, curriculum ideology can become a voluntary practice among educators.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- [1] Zhang W, Chen YQ. 2020. Multi-subject concept innovation and implementation path of "three complete education" in universities. *Higher Education of China*, 10:13-15.
- [2] Du J, Zhang H, Feng T. 2022. Exploring the path of "three complete education" based on the integration of educational elements. *Heilongjiang Education (Research and Evaluation of Education in Higher Education)*, 1:88-90.
- [3] Cai ST, Li WJ, Zhang Y. 2018. Three-dimensional evaluation practice of graduation requirements in engineering education certification. *Higher Engineering Education Research*, 2:71-76.
- [4] China Engineering Education Professional Certification Association. Engineering Education Certification Standard, 2022.7.15. <https://www.ceeaa.org.cn/gcjyzyrzh/rzcxjzbz/gcjyrbz/index.html>.
- [5] Li JG, Wang X, Sun SS, et al. 2020. Ideological and political examination of courses under the background of engineering education professional certification. *Chemical Industry Higher Education*, 4:49-53.
- [6] Liu FJ, Song ZC. 2019. Examination of ideological and political education for college students from the perspective of recessive education. *Heilongjiang Higher Education Research*, 1:120-124.
- [7] Liu G, Wang PL, Gao H. 2021. Integration and effect analysis of ideological and political elements in applied electrochemistry teaching. *Journal of Huaibei Normal University (Natural Science Edition)*, 42 (2):82-85.
- [8] Zhao Y*, Lan DW, Ma LT. 2021. The construction of the system of engineering education. *Guangdong Chemical Industry*, 48 (11): 202-203+220.
- [9] Zhou M. 2021. Cluster analysis and trend outlook of the research literature on "craftsman spirit". *Journal of Wuhan Vocational and Technical College*, 129 (1): 26-33.
- [10] Xiao QZ, Liu YC. 2015. The craftsman spirit and its contemporary values. *Social Sciences in Hunan Province*, 6: 6-10.